

June 25, 1946.

T. H. CLARK

2,402,603

DISTRIBUTOR

Filed March 13, 1944

2 Sheets-Sheet 1

Fig. 3.

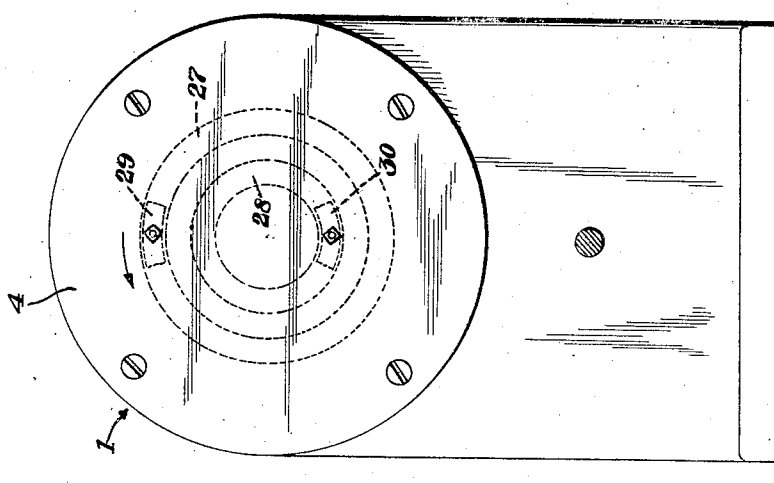


Fig. 2.

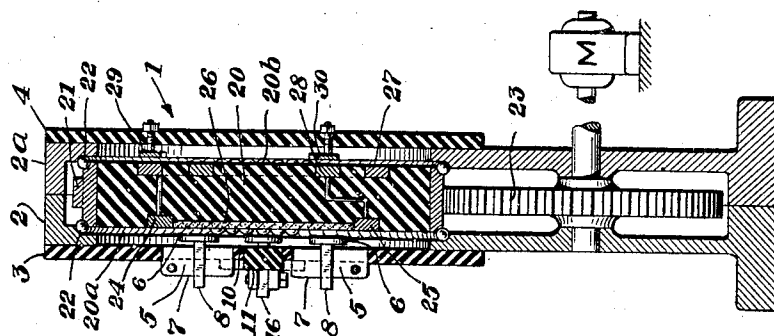


Fig. 1.

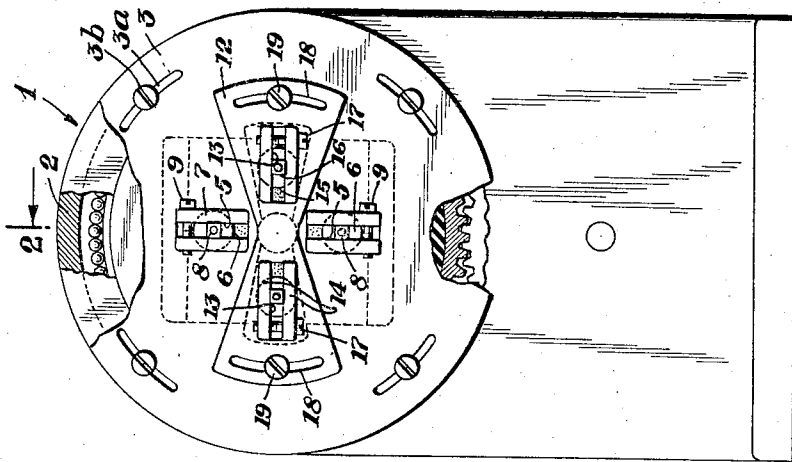


Fig. 4.



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Fig. 6.

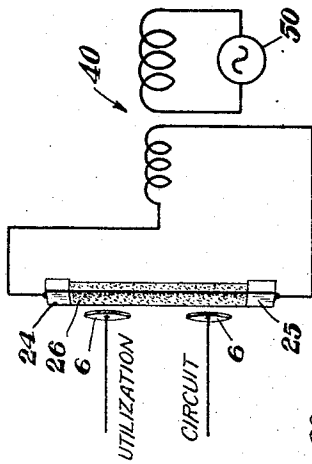


Fig. 8.

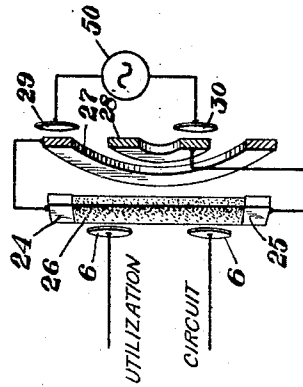


Fig. 9.

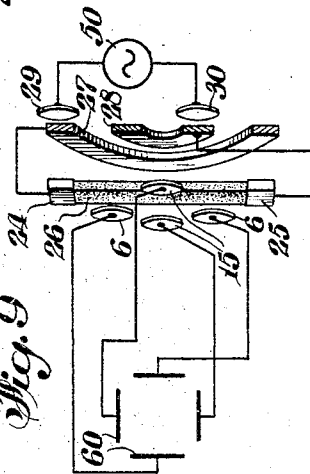


Fig. 5.

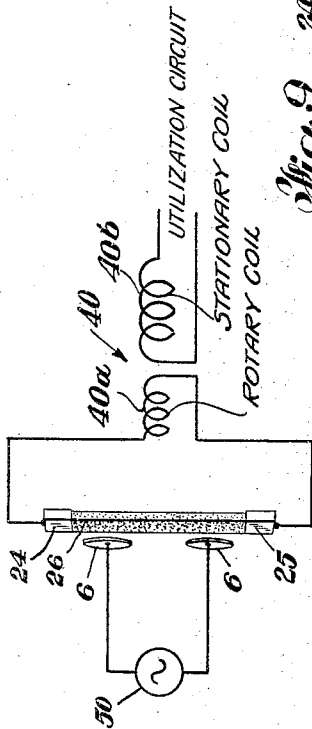
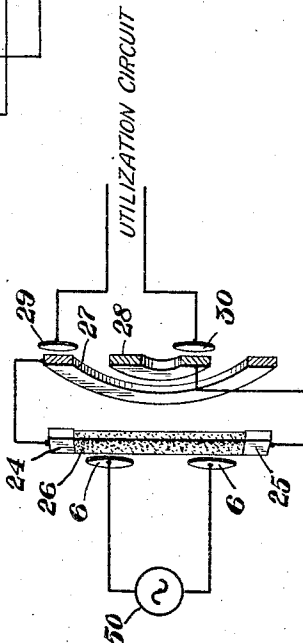


Fig. 7.



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DISTRIBUTOR

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Application March 13, 1944, Serial No. 526,290

9 Claims. (Cl. 179—171.5)

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This invention relates to distributors and more particularly to rotary types employing elements in capacitive relation for the distribution of current.

In a copending application filed jointly by applicant and Avery G. Richardson on December 6, 1943, Serial No. 513,198, and titled "Resistance sine wave generator" is shown a device whereby a relative rotary movement between a resistor unit and a plurality of contact brushes is used to transform a direct current into an alternating current.

However, certain objectionable features have been found to be present in distributors wherein brushes of carbon or the like are employed.

Due to the constant pressure needed to maintain the proper contact between the brushes and the rotary member an over-abundance of friction is produced. This friction causes the brushes to wear away depositing certain amounts of their material upon the surface of the resistor unit and causing untold amounts of disturbances.

If the contacting surfaces of the brushes or the resistor are of an uneven character, arcing occurs and sets up disturbing noises in all of the circuits within range of the distributor. It has also been found that if the material worn away from the brushes remain deposited upon the surface of the resistor unit the resistive quality of the resistor unit will become ineffective and an improper distribution will result.

One of the objects of this invention is to produce a distributor which will be devoid of all such objectionable features as stated above.

A further object is to produce a simple and inexpensive distributor for the proper distribution of current.

A still further object is to produce a distributor wherein the distribution of current is accomplished by capacitive relation of the elements therein.

A still further object is to produce a distributor wherein the proper output for a given input will be maintained at all times.

A still further object is to produce a distributor wherein capacitive electrodes may be employed.

One of the features of my invention is to produce a distributor provided with a housing having a rotary disk therein. Mounted upon said disk is a resistor unit having conductor bars overlying oppositely disposed edges and connected to a pair of spaced apart conductor rings. Also mounted within said housing are a plurality of electrodes or condenser plates in capacitive relation to the surface of said resistor unit. If a

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source of voltage, e. g. an alternating voltage, is applied to the conductor bars, a voltage drop is produced in said resistor. Accordingly adjustment of said electrode toward or away from each other or relative to the conductor bars will vary the voltage drop from points on the resistor unit opposite the electrodes to the conductor bars. By use of means for creating relative rhythmic movement, such as rotary movement, between the electrodes and the resistor unit while maintaining them in capacitive relation a radio frequency envelope modulated in amplitude at the speed of the relative movement and devoid of noises or fluctuations of the amplitude will be produced. A still further feature lies in the provision of a second pair of electrodes to produce a second envelope. Angular adjustable means may be provided for the first and second electrode pairs to permit adjustment of the phase of both envelopes in accordance with the angular position of the two pairs of electrodes. A still further feature lies in the provision for mounting still another pair of brushes in capacitive relation to the conductor rings to transfer energy to or from the resistor unit without the use of sliding contacts.

Further and ancillary objects and features of my invention will become apparent in the following description and drawings wherein:

Fig. 1 is a front elevational view partly shown in section of a structure embodying the principles of my invention;

Fig. 2 is a vertical section taken along the lines 2—2 of Fig. 1;

Fig. 3 is a rear elevational view of the structure shown in Fig. 1;

Fig. 4 illustrates plan views of modified forms of capacitor electrodes that may be employed in my distributor; and

Figs. 5, 6, 7, 8 and 9 are schematic circuit diagrams showing applications of my invention.

Referring now to Figs. 1, 2 and 3, there is shown a distributor 1 having a split housing 2—2a provided with insulated cover plates 3 and 4. Cover plate 3 is provided with slotted openings 5 for the insertion of the shanks of capacitor electrodes or plates 6. These slotted openings 5 radiate from the center of the cover plate 3 and are provided with raised edge portions 7 to accommodate the square shanks 8 of each of the capacitor electrodes 6 in an adjustably fixed position with respect to the center of the cover and in the proper capacitive relation to the surface of a resistor unit 26. Near the remote ends of said raised edge portions 7, are clamping screws 9

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adapted to maintain the capacitor electrodes in an adjustably fixed position. Near the outer periphery of the cover plate 3 are formed arcuate slots 3a concentric to the axis of rotation to provide for a rotary adjustable movement of said cover plate with consequent rotary adjustment of the capacitor electrodes, and adapted to be held securely to the housing by screws 3b. The center of said cover plate is also provided with a cylindrical opening 10 adapted to receive a depending portion 11 of an auxiliary cover 12. This auxiliary cover is provided with slotted openings 13 having raised edge portions 14 to accommodate the square shanks 16 of capacitor electrodes 15 in an adjustably fixed position. Near the remote ends of said raised edge portions of the slotted openings 13 there are provided clamping screws 17 to maintain the capacitor electrodes 15 in an adjustably fixed position with respect to one another and in proper capacitive relation to the surface of the rotatable resistor. The auxiliary cover also has provided near its outer periphery arcuate slots 18 concentric to the axis of rotation for the rotatably adjustable movement of said auxiliary cover with respect to said cover plate 3 and consequent rotary adjustment of electrodes 15 with respect to electrodes 6, and held in adjustably fixed position by locking screws 19.

Mounted within the casing 2-2a is a rotatable disk 20 of dielectric material provided with a gear 21, ball races 22 and adapted to be rotated by another gear 23 driven by a motor M adjacent the outside of the distributor.

Imbedded in the face 20a of the disk 20 is a flat plate or layer 26 of resistive material, for example, carbon or the like, whose four edges are equidistant from the geometrical center of said disk and so proportioned to have a linear voltage drop between any two spaced points. Also imbedded in the same face of disk 20 are two conductive bars 24, 25, overlying the oppositely disposed edges of resistor plate 26 the lengths of each of the conductor bars being substantially the length of any one edge of the flat plate 26. This flat resistor plate and the conductor bars together form the complete resistor unit of the distributor and may be fastened into the disk in any well known manner.

Imbedded in the opposite face 20b of the disk 20 are two spaced apart collector rings 27, 28 of conductive material positioned concentrically to each other and the axis of rotation. The outer ring 27 is connected electrically to the conductor bar 24 while the inner ring 28 is connected electrically to the conductor bar 25. Mounted on the inner face of the cover 4 are two capacitor electrodes 29, 30 adjustably mounted to provide a capacitive coupling between said electrodes and the surface of collector rings 27, 28, the shanks of the electrodes providing electrical terminals on the outer surface of said cover 4.

Instead of collector rings 27 and 28 and their pick-up electrodes 29 and 30, for capacitively coupling the rotor and stator of my novel device, inductive coupling means may be employed, as shown in Figs. 5 and 6. One winding, 40a, of transformer 40 is connected across the resistor 40 and the other winding, 40b, is connected to exterior or output terminals of the device. Winding 40a may be given a conventional pancake form and its turns imbedded in or carried on the face 20b of disk 20 in the manner suggested for the rings 27, 28 in Figs. 1 and 2, the two ends of the winding being passed through the disc and connected to bars 24 and 25. The stationary winding

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40b, carried on plate 4 would preferably also be of the pancake type for close coupling with the rotating winding, the two windings being carefully positioned concentrically with the axis of rotation to eliminate variations in coupling as the disc 20 turns.

The structure described above may be used to amplitude modulate an alternating current or voltage wave, the envelope of the modulated wave having undulations determined by the relative rotation of the resistor and the electrodes capacitively coupled thereto. A few examples of this unit applied to circuits for producing the desired converting distribution are shown in Figs. 5, 6, 7 and 8.

As shown in Fig. 5 a source of alternating voltage 50 is connected to capacitor electrodes 6. This connection produces a voltage difference between electrodes 6 and conductor bars 24 and 25. Because of this potential difference and the capacitive coupling current from source 50 is applied to conductor bars 24 and 25 and over rotary transformer 40 to a utilization circuit. Relative rotation between the resistor 26 and electrodes 6 causes variation in the potential drop in resistor 26 between points on the resistor surface opposite the electrodes 6 and conductor bars 24 and 25. This variation in potential drop causes changes in the amplitude of the output current to the utilization circuit at a frequency determined by the rate of the relative rotation.

The circuit shown in Fig. 6 is substantially that shown in Fig. 5. However, instead of the source 50 being connected to electrodes 6 it is now connected to the stationary coil of the rotary transformer 40. As the rotary transformer is inductively coupled energy will be transmitted therefrom to the utilization circuit over the conductor bars 24 and 25, resistor 26, then by capacitance to the electrodes 6. Here again the relative rotation of the resistor 26 together with conductor bars 24 and 25, will cause a variation in the potential drop in the utilization circuit, connected to the electrodes 6, and the same changes in the current amplitude to the utilization circuit at a frequency determined by the rate of relative rotation.

The circuit shown in Fig. 7, although similar in most respects to Fig. 5, differs only in the fact that the output of the source 50 after being transferred capacitively by the electrodes 6 to the resistor 26 and its accompanying conductor bars 24 and 25 is capacitively transferred to the utilization circuit. This is accomplished by connecting the conductor bars 24 and 25 of the resistor 26 respectively to a pair of conductor rings 28 and 29 which are positioned concentric to the axis of rotation of the resistor 26. A pair of electrodes 29 and 30 capacitively transfer the current from the conductor rings 29 and 28 to the utilization circuit. Here again as in Fig. 5 the same potential drop of current from source 50 to the utilization circuit will take place, and the same changes in current amplitude at a frequency determined by the rate of relative rotation.

The circuit shown in Fig. 8 differs from Fig. 7 only in the fact that the source of power 50 is connected to the electrodes 29 and 30 instead of electrodes 6. The transfer of the current from source 50 to the utilization circuit is now reversed, but the conditions within the utilization circuit will have the same potential drop and the same changes in current amplitude as in Fig. 7.

Should there be a requirement for advancing or retarding the capacitor electrodes 6, as a unit,

this could be accomplished by simply loosening the screws 35 and rotatably adjusting the cover plate 3. If for any reason whatsoever the advancing or retarding of one set of capacitor electrodes relative to the other set is required, this could be accomplished by simply loosening the locking screws 19 in the auxiliary cover 12.

Many uses or applications of my invention can be envisioned, either separately or in combination with other electrical apparatus. Should the electrodes opposite the surface of the resistor be connected to a loop antenna the distributor would readily take the place of, and be a substitution for, a goniometer for the location of radio waves. Where the two pair of electrodes 15 and 6 are used, opposite the surface of the resistor, and are angularly adjustable to each other any phase difference from 0 and 90° can be maintained between the modulating waves in the two circuits of the two pairs of electrodes. When a source of current is fed to the resistor unit and by capacitance transferred to one pair of electrodes connected to oppositely disposed deflection plates in an oscilloscope, a linear sweep will be produced across the fluorescent screen. A circular sweep can be produced by the use of two pair of the electrodes 15 and 6 placed 90° apart and connected to the four deflections elements 66 of the oscilloscope, as shown, by way of example, in Fig. 8.

Should there be the necessity of rotating the electrodes instead of the disk and its elements, it would not require much ingenuity to construct a housing wherein this could be made possible. Nevertheless the relative rotary movement between all the elements would not change, but would remain as stated in the appended claims.

It is to be clearly understood by those skilled in this art that the apparatus shown and described herein is only illustrative of my invention and is not to be construed as a limitation on the scope of my invention as set forth in the objects and appended claims.

I claim:

1. A capacitive distributor comprising a resistor unit having a resistance distributed over a given area to provide a resistor surface, a first pair of terminals, means for coupling said first pair of terminals in capacitive relation to said resistor surface, means for producing relative rotary movement between said resistor unit and said first pair of terminals, a second pair of terminals, and means for coupling said second pair of terminals to spaced points on the perimeter of said resistor unit.

2. A capacitive distributor according to claim 1, further comprising a source of alternating current connected to one of said pairs of terminals, and a utilization circuit connected to the remaining pair of terminals.

3. A capacitive distributor comprising a resistor unit having a resistance distributed over a given area to provide a resistor surface, a first pair of terminals, means for coupling said first pair of terminals in capacitive relation to said resistor surface, means for producing relative rotary movement between said resistor unit and said first pair of terminals, a pair of spaced apart conductor rings connected to spaced points on the perimeter of said resistor unit, a second pair of terminals and means for capacitively coupling

said pair of conductor rings to said second pair of terminals.

4. A capacitive distributor comprising a resistor unit having a resistance distributed over a given area to provide a resistor surface, a first pair of terminals means for coupling said first pair of terminals in capacitive relation to said resistor surface, means for producing relative rotary movement between said resistor unit and said first pair of terminals, a pair of conductor bars overlying oppositely disposed perimeter edges of said resistor unit, a second pair of terminals, and means for coupling said conductor bars to said second pair of terminals.

5. In a capacitive distributor, the combination of a housing, a disk of substantially circular configuration mounted within said housing, a resistor unit mounted on said disk having a resistance distributed over a given area, to provide a resistor surface, a first pair of capacitor electrodes mounted within said housing in capacitive relation to the surface of said resistor unit, a pair of spaced conductor rings mounted on and concentric to the axis of said disk and connected to spaced points on the perimeter of said resistor unit, and a second pair of capacitor electrodes mounted within said housing in capacitive relation to said conductor rings.

6. In a capacitive distributor according to claim 5, further comprising means for producing a relative rotary movement between said resistor unit and said conductor on one hand, and said first pair and said second pair of capacitor electrodes on the other.

7. In a capacitive distributor, the combination of a housing, a disk of substantially circular configuration mounted within said housing, a resistor unit mounted on said disk having a resistance distributed over a given area to provide a resistor surface, a pair of conductor bars overlying oppositely disposed perimeter edges of said resistor unit, a first pair of capacitor electrodes mounted within said housing in capacitive relation to the surface of said resistor unit, a second pair of capacitor electrodes mounted within said housing, means for capacitively coupling said pair of conductor bars to said second pair of capacitor electrodes, and means for producing relative rotary movement between said resistor unit and said pair of conductor bars on one hand, and said first pair and said second pair of electrodes on the other, said coupling means including a pair of spaced apart conductor rings respectively connected to said overlying pair of conductor bars and concentric to said disk.

8. In a capacitive distributor, the combination of a resistor having an extended resistance surface, terminals connected to spaced points on said resistance surface, a condenser plate mounted in spaced capacitive relation with said surface, said plate being movable over said surface to vary the distance between said plate and said points.

9. In combination, a resistor having an extended resistance surface, a capacitor electrode mounted in capacitive relation to said resistance surface, electrical connections to spaced points on said resistance surface, means for rhythmically moving said capacitor electrode over said surface.

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